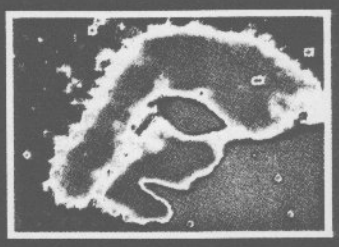
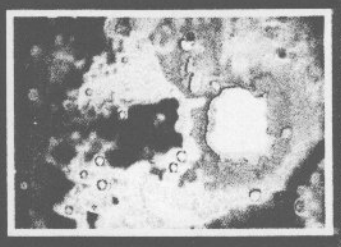
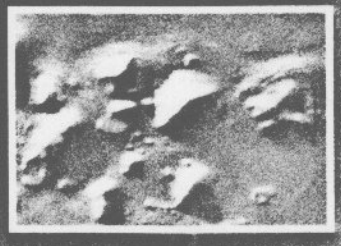


CASTING A NEW LIGHT ON THE

MARS FACE

ARTICLE BY ROBERT C. KIVIAT





MARS FACE

CONTINUED FROM PAGE 36

my at Cornell University and chairman of the Mars Science Working Group, which consists of scientists from both government and private universities and advises NASA on its Mars exploration program. "And it's an issue that I think could be nicely put to rest, once and for all, if we could get one good picture of this thing."

That doesn't mean that Squyres subscribes to Hoagland's hypotheses regarding Cydonia or that he agrees with Carlotto's shape-from-shading analysis, which he says demonstrates only that the structure looks like a face. "Neither shape-from-shading nor your own visual analysis of this thing tells you *how* it got that shape," Squyres says. "So you can massage the data all you want, but the fact is that we have a very fuzzy, low-resolution picture of the face, and we're not going to know how it was formed until we take a higher-resolution picture."

The camera that may capture that picture will fly on just one of the two orbiters that NASA currently plans to send to Mars. Both the Mars Science Working Group and NASA's own team formed to study plausible Mars-exploration options in the wake of the *Observer*'s failure endorsed the two-orbiter approach, splitting essentially the entire *Observer* payload between the two spacecraft due to be launched in 1996 and 1998, Squyres says. They also recommended a series of lander missions that NASA will begin in 1997, when the *Mars Pathfinder* spacecraft lands on the planet's surface and deploys a small rover.

Described by Squyres as "an engineering experiment" with a very modest scientific payload, the *Pathfinder* mission gives NASA an opportunity to showcase its new commitment to quicker, cheaper, but perhaps riskier missions. Shortly after the loss of *Mars Observer*, NASA Administrator Daniel Goldin told NBC News that the agency had introduced a "policy where we build smaller spacecraft in larger number, so we don't have to risk everything on any given launch." With *Pathfinder*, Squyres says, NASA is spending just $150 million to build a "completely new type of spacecraft and successfully land it on the Martian surface and deploy instruments."

NASA will likely send the camera aboard the first orbiter, enabling it to take high-resolution photographs of the planet's surface that will help NASA select *Pathfinder*'s landing site and decide where to send the rover. "It makes a certain amount of sense to put the highest priority on those orbital objectives that will enable us to do the landed science better," Squyres says. "There are other factors besides science that come into it, too. One is having an instrument on there that the public can deal with. An imager is important from the standpoint of making sure that the public sees comprehensible, tangible results from the mission."

The camera on the new spacecraft will do more than simply transmit images to flash across America's TV screens, of course. If, as planned, NASA intends it to duplicate the mission of the *Observer*'s camera, it will photograph the entire surface of the planet, producing detailed maps. In addition, the camera was designed to help test some hypotheses regarding the planet's geology by focusing on some specific geological features. The Cydonian structures are not among those features of highest geological interest. Accordingly, although Michael Malin, the principal investigator in charge of *Mars Observer*'s camera and the camera that will fly aboard that craft's replacement, attests that he'll "try the best he can" to get high-resolution photos of the face and other nearby objects, he doesn't think they should be his *highest* imaging priority.

> "THE FACE ON MARS IS AN ISSUE THAT I THINK COULD BE NICELY PUT TO REST, ONCE AND FOR ALL, IF WE COULD GET ONE GOOD PICTURE OF THIS THING," SAYS STEVEN SQUYRES.

Complicating the entire issue are the rather severe limitations of the camera and of transmitting data through space. The camera will photograph less than one percent of Mars' surface in high resolution—not because it can't photograph more, but because there's no room in the probe's transmission stream for the additional data to be sent back to Earth. And pinpointing exactly what on the surface it photographs is far from simple: Bolted to the spacecraft, the camera can only point straight down. "We always said that it was very difficult to image the face because of the targeting ability of the whole system," says Arden Albee, project scientist on the *Mars Observer* mission and a member of NASA's Mars Recovery study team.

"That hill that we're trying to take a picture of in Cydonia is very small—it's only a couple of kilometers—and the field of view of Malin's camera when it takes a picture of the surface is also very small," Squyres explains. "But the really important point is that the spacecraft is not able to point very accurately at all. If you build into the spacecraft, at great expense, the capability to point your camera very precisely and the capability to determine the orbit and the orientation of the spacecraft very precisely, then you can hit a specific imaging target."

While Squyres recognizes that there may be considerable public interest in the face, he doesn't believe that it mandates photographing the face at all costs. "But if Congress decided that they wanted to put so much money into the *Mars Observer* follow-on mission that we could afford to point that camera with high enough precision to put this issue to rest," he adds, "that would be great." Frankly, he doesn't think that Congress will take such a step in the current economic climate.

NASA might get Congress to cough up the additional funds by playing up the "Mars face" angle to the public, which would demand action from its elected officials. But Squyres considers such tactics "intellectually dishonest. If you mislead people by making something sound particularly likely, when in fact your personal view is that it's not," he says, "sooner or later it's going to come back and haunt you."

And although Squyres and the NASA investigators insist that they are open to any new evidence that the Mars probes may turn up, they don't at present believe that it's likely that the Cydonian structures are artificial. "[Carlotto's] shape-from-shading argument is unconvincing because it doesn't prove anything," Malin says. "Just because a hill looks like a face doesn't prove that it is a face. In my view, the face barely resembles one, and there is certainly nothing in its form or topography that is even suggestive of its being artificial." Carlotto has also applied fractal analysis to photographs of the face, the results of which, he says, indicate the face is anomalous. In order to prove, however, that the face is

anomalous on Mars, Malin says. Carlotto must examine as "many locations on Mars in mountainous terrains and show that only the things in the Cydonia area—pyramids and the like—are highlighted by his technique." Even such results, he adds, would suggest simply that the features "are different, not that they are artificial."

And what does Malin think of Hoagland's assertion that the alignment of the face and other objects indicates unnatural origins? "I don't know of very many scientists who would endorse it because there is no physical basis for it," Malin says. If aliens did create the structures Hoagland points to with the intention of leaving a message, Malin contends that "they picked a very poor place to do it because the area is already fractured by Mars—which created a lot of angles there." As for the pyramids, Malin says that natural forces do, in fact, produce such structures. "I've done a lot of work in Antarctica, and there are lots of pyramidal shapes cut by ice," he explains. "They can also be formed by other processes of erosion, and there are far stranger things in Antarctica than I have seen on Mars."

Another figure involved in the debate, however, has taken issue with Malin's arguments against the Cydonian structures' artificial origins and indeed with NASA's treatment of the Cydonia issue as a whole. Stan McDaniel, a professor of philosophy at Sonoma State University with a 30-year background in such areas of study as ethics, philosophy of science, and critical thinking, has conducted a two-year study of NASA's official policy regarding the face and the methodology that both NASA and the independent investigators have employed in analyzing it. Many of NASA's arguments against the independent investigators' conclusions are "seriously flawed, both in terms of methodology and logic," McDaniel says. Moreover, the methodology used by DiPietro, Molennar, Carlotto, Torun, and Hoagland "is sound," based on established scientific criteria, he says.

"NASA itself uses the shape-from-shading technique to determine the probable three-dimensional shape of objects in space photographs," McDaniel says. The fractal analysis technique used by Carlotto "is a standard scientific method in use" for determining the probable artificiality of objects in satellite images, he adds. And in McDaniel's view, "the magnitude of the issue at stake—which is the possible proof of the existence of extraterrestrial intelligence"—should compel NASA to ensure that any new Mars orbiter takes high-resolution photographs of the landforms by making them a top mission priority.

Hoagland founded the Mars Mission, a grass-roots constituency organization composed of researchers and lobbyists, to do just that. The group has dedicated itself to ensuring that NASA obtains high-resolution images of the face and other nearby objects at Cydonia at the earliest opportunity and then immediately releases them to the U.S. public.

That issue, however, could soon be moot: It may not be a U.S. spacecraft that gets the next opportunity to take high-resolution images of the curious structures. In 1996, the Russians plan to launch a Mars orbiter equipped with a German camera, and "if it overflies the Cydonia area and takes a picture of the face," Squyres says, "it will be able to do a very nice job of imaging it at a high resolution and putting the issue to rest."

Regardless of whether a U.S. spacecraft or a Russian one takes the coveted high-resolution picture of the face and, ideally, the surrounding structures, those on each side of the issue know what the image must show to vindicate their arguments—and what would reveal that they are mistaken. For Malin, a photo of the area near the face showing "roads or large areas that have been excavated" will prove his hypothesis wrong. "On the other hand, if we see just a natural-looking surface, then I would argue my hypothesis is correct," he adds. For Hoagland, only fractal analysis of high-resolution photos indicating that the objects are part of the natural terrain will dissuade him from the views he's firmly held for the past ten years.

And despite the unexpected failure of the *Mars Observer*, Hoagland, Malin, and the rest of the world could know before the decade is out the elusive truth—whatever it may be—behind the mysterious monuments of Mars.

Do you think the government is covering up information about the structures on Mars? Do you believe the Mars face was constructed by extraterrestrial life forms? Call **(900) 285-5483** and voice your opinions. Your comments will be recorded and may appear in an upcoming issue of *Omni*. The cost for the call is 95 cents per minute. You must be age 18 or older. Touch-tone phones only. Sponsored by Pure Entertainment, 505 South Beverly Drive, Suite 977, Beverly Hills, California 90212.

such intelligence in satellite photos. In an episode of the *Cosmos* television series called "Blues for a Red Planet," Sagan demonstrated that "intelligent life on Earth first reveals itself through the geometric regularity of its constructions"—an intricate pattern of straight lines, squares, rectangles, and circles. Canals, roads, and circular irrigation patterns, he explained, "all suggest intelligent life with a passion for Euclidean geometry." But the Viking spacecraft, Sagan concluded, didn't detect any such manufactured structures. Nevertheless, Hoagland maintains that the Viking photos of Cydonia *do* show intelligently constructed objects—not just random hills and mountains—because there is "geometric regularity"—but not exactly the kind for which Sagan had searched.

"The large Cydonian pyramid is a geometric figure on Mars that has internal angles which are identical to those that can be measured between the face, the city, and other key surface features nearby," Hoagland says. "The meaning in this is that if you find a specific geometry in the pyramid and then you find a bigger example of the same geometry spread out over many more square miles, it's telling you something—that it's not natural."

Some others who have studied the photos Viking sent back, however, have failed to arrive at the same conclusion. "I don't know any people of any consequence who give any credence to this whatsoever," declares Michael Carr, who headed the Viking orbiter imaging team. "Not one person of scientific credibility believes this." In addition, Carr, presently a geologist with the U.S. Geological Survey, says he doesn't know of a "single Viking image that has pyramids on it." Although some members of the JPL staff did note the mesa's resemblance to a face when Viking sent back that particular image, he admits, the lab published it "only for laughs."

But still other members of the scientific community—even some at NASA—believe the face and nearby objects merit further study. Mark Carlotto, a former division staff analyst with the image-computing technology division at TASC—an analytic services corporation that performs satellite-based image processing—began examining the Viking data in 1985 after reading about Hoagland's studies. Carlotto's expertise in analyzing satellite images has made him a key player in the investigation.

"The mesa obviously looks like a

had enhanced it," Hoagland says. "Their photographs showed some remarkable, stunning detail that was not at all evident on the raw image."

DiPietro and Molennar had searched through the entire Viking data file and had found a second picture—taken 35 days later—that reveals more of the right side of the face due to the sun's slightly higher position in the Martian sky. Still, Hoagland wasn't convinced that the face was an artificial construction until 1983, when DiPietro sent him photographic blowups of the face along with prints of original Viking frames for comparison. "As I sat there looking at the photographs," Hoagland says, "I began to wonder why no one had taken this seriously, and what if it wasn't just a trick of lighting?"

Hoagland soon agreed with DiPietro and Molennar that the face appeared bilaterally symmetric. "It had features which were humanoid," he remembers, "and it seemed above chance that it also had the right proportion." He then speculated that if sentient life forms had indeed constructed the face, they might have built it to be seen from the ground rather than from the air.

He then attempted to determine where one would have had to stand on the planet's surface to see the face. "That's when my eyes were forced to look to the left and the right," he says, "and I noticed a separate collection of very geometric pyramid shapes, where one would have had a perfect view of the face." He reasoned that these pyramids could be the ruins of an ancient city of some sort.

In a previously published report titled "Unusual Martian Surface Features," DiPietro and Molennar had also described "a monstrous, rectangular pyramid," located ten miles southwest of the face. They noted that its dimensions were roughly 1 mile long by 1.6 miles across, it appeared to have four sides that descended straight down to the surface at "sharp angles," and its corners seemed buttressed by "symmetrical material." Hoagland believed it's unlikely that two very unnatural-looking objects like the face and the pyramid would exist on Mars in such close proximity.

Erol Torun, a physical scientist with the Defense Mapping Agency who has on his own time studied the large pyramid, corroborates DiPietro's and Molennar's findings. The pyramid's "position and orientation—in respect to other suspicious objects in the immediate vicinity—are perfectly aligned," he says. The pyramid's main axis aligns with the face, he explains, and an extension of the left arm of the pyramid

face," says Carlotto. "It always did to me, and that was the intriguing thing that piqued my curiosity to make me take a closer look at the data." Carlotto, author of *The Martian Enigmas*, has specifically attempted to test the validity of NASA's trick-of-lighting explanation for the face. Using a "shape-from-shading" image-analysis technique that creates a three-dimensional image from two-dimensional data, he has concluded that "the impression of a face is not a trick of lighting. Three-dimensional imagery suggests that the impression of facial features persists over a wide range of illumination and viewing conditions."

While the face has received the most attention, another object that Hoagland discovered back in 1983 and termed the "fort" is perhaps the most interesting feature in the Viking frames, according to Carlotto. "I characterize this as a polyhedral object," Carlotto says, "with very straight sides and regularly shaped markings or indentations." When he used shape-from-shading to create a 3-D image, he adds, "this object appeared to be an enclosed structure that had somehow lost its top. It did not look natural."

Other tests Carlotto has performed indicate that the face and some other Cydonian objects are strongly nonfractal, meaning they don't appear to have occurred naturally. Using some techniques developed at TASC to detect manmade structures in satellite images, he and some colleagues determined that the face doesn't share the characteristics of the terrain that surrounds it.

Hoagland, Carlotto, and others investigating the structures have concluded that only high-resolution photos, the type *Mars Observer* was to take, can lay the mystery of Cydonia to rest. But the *Observer*'s camera, while capable of taking pictures 30 times sharper than Viking's, had targeting limitations that made it quite possible that the probe wouldn't have captured sharp photos of the structures in question—and the new spacecraft currently on the drawing board will carry the same type of camera. So even if the new probes get off the ground, we could be left without high-resolution pictures of the face and other structures unless NASA—or another organization capable of sending a spacecraft to Mars—makes photographing the Cydonian monuments a mission priority.

"There's been a lot of discussion, some of it well-informed and some of it not particularly well-informed, having to do with this feature on Mars," says Steven Squyres, professor of astrono-

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A CALL FOR PUBLIC AND SCIENTIFIC RESPONSIBILITY

BY STANLEY V. McDANIEL

A scientifically derived hypothesis, supported by a mounting file of carefully developed data, has been put forward as the result of over a decade of painstaking work by several teams of highly qualified independent investigators, employing state-of-the-art techniques. The hypothesis does not claim there is proof of artificial features on Mars. It claims only that the probability is strong enough to make new high-resolution photographs a top priority for any future mission to Mars.

In my intensive, detailed study of this subject (*The McDaniel Report*, North Atlantic Books, Berkeley, California, 1994), I adopt the following principle: *Any reasonable degree of doubt regarding the natural origin of any of the debated features creates a profound and compelling ethical obligation for NASA to give extremely high priority to obtaining new high-resolution images of these landforms.*

Former NASA astronaut Joseph P. Kerwin writes: "You could put it in the form of an equation. The importance of gleaning further information on certain Martian objects equals (the likelihood of their being the products of intelligent manufacture) times (the importance of that fact if proven true). Now, no matter how small the first number is, as long as it isn't zero, the equation is going to return a sizeable total, because the second number is *big!*"

NASA has failed to take into account the ethical equation, and has failed to grant appropriate priority to obtaining new images of the landforms. The situation is critical. For the first time in the history of the space program, control of the imaging facility has been turned over to a private contractor who can delay release of the data for a black-box period of as long as six months, has a demonstrable lack of interest in the artificiality hypothesis, and has been given sole authority by NASA to determine which objects are to be photographed. By means of a technicality, NASA has now introduced an unprecedented restriction on imaging data acquisition and release.

ISN'T IT ABOUT TIME FOR NASA TO LOOK CLOSELY AT THE POSSIBILITY OF ARTIFICIAL STRUCTURES IN CYDONIA? A REQUEST FOR ACTION.

This situation is cause for alarm. In my report, I put forward recommendations to prevent the impending scientific disaster of failure to obtain new photographs of Cydonia, and restore public confidence in NASA's commitment to unbiased exploration of the solar system. These recommendations include the following:

NASA and any private contractor involved in imaging, by agreement, will assign a level of priority to suspect landforms that will ensure the obtaining of high-resolution photographs of those landforms, using all means at their disposal, subject only to uncertainties beyond their control.

Imaging data gathered during camera passes over the area specified will not be subject to the proprietary aspects of the principal investigator's contract with NASA. This includes the raw data prior to processing, but after the camera data has been separated from that of other instrumentation.

The scientific community and the general public will be given advance notice, within the constraints of predictability, as to when each pass over the area will occur, in order to prepare to receive the data.

The raw data for the specific area will be released to scientists and to the public immediately upon receipt at JPL (the Jet Propulsion Laboratory), with no time delay. Video image conversion of the data received in the same passes will be released immediately in a continuous stream to NASA Select-TV, PBS, and others who desire to receive it.

In the interest of science, I urge the readers of *Omni* to support these recommendations by writing to Daniel Goldin at NASA in Washington, DC, and to their local congressional representatives.

Editor's note: You can get more information about The McDaniel Report *by calling 213-964-2500. And join the debate on this provocative topic by visiting Omni Online via America Online.*

intersects the center of the city, while an extension of its right arm intersects a peculiar object that Hoagland calls the "tholus." The pyramid displays "geometric regularity," Torun concludes, that doesn't occur in nature.

Hoagland, too, noticed during the early part of his 11-year study that the face and the city appear to be aligned rectilinearly; a series of right angles contributes to an overall impression that the city's main avenue leads toward the face. Yet Hoagland recognizes that "earthquakes or faulting will give you rectilinearity," and so the phenomenon isn't conclusive proof of the structures' artificiality. "But what is conclusive," he explains, "are the much more subtle angles—measured between these and other objects arrayed at Cydonia—that are replicated with such geometric regularity that they seem to be the product of intelligent design. It's a repeating of the same pattern of angles between the specific objects, and within the large pyramid itself."

The patterns he has found in Cydonia, Hoagland believes, are similar to the sort of constructions that well-known planetary scientist Carl Sagan considers indicative of intelligent life. Sagan has attempted to identify patterns of intelligent activity on Earth—and Mars—via satellite images, and although his studies found no signs of intelligent life on the Red Planet, they did establish criteria for identifying

When the *Viking 1* spacecraft arrived at Mars in July 1976, it fell into orbit around the Red Planet. Sending its lander down to inspect the surface below, the orbiter concentrated on picking out possible landing sites for the *Viking 2* spacecraft, due to arrive in a few weeks. Its cameras shot thousands of pictures as it circled within 1,000 miles of the planet's rugged features.

On the morning of July 26, 1976, the Jet Propulsion Laboratory (JPL) in Pasadena, California, received a set of images taken during *Viking 1*'s thirty-fifth orbit of Mars. One of those frames, from the northern desert region called Cydonia, showed a mesa—roughly a mile long and 1,500 feet high—that resembled a humanoid face.

"At a press conference at JPL, Viking project scientist Dr. Gerald Soffen popped up a slide showing this very quirky image in the Martian desert," recalls Richard C. Hoagland, then a member of the JPL press corps. "As reporters were poised with pens ready, Soffen said a picture taken a few hours later showed that 'it was just a trick, just the way the light fell on it.'" But according to Hoagland, that simple explanation for what has become known as "the face on Mars" has proven to be "flatly, demonstrably, in gross error."

NASA's planetary scientists have maintained over the years that the face is a natural rock formation produced by wind erosion and that the particular lighting angle at which it was photographed created its resemblance to a human face. Hoagland, however, remains unconvinced, and he has led a ten-year independent investigation of the Viking data. After analyzing specific frames, taken with different sun angles during orbits weeks apart, he contends, his interdisciplinary team of researchers has found substantial evidence that the face, some adjacent pyramid structures, and other objects on Mars' surface were created by intelligent beings.

On August 21, 1993, the *Mars Observer* spacecraft was preparing to settle into orbit around Mars to begin a two-year mission to photograph and analyze the surface of the Red Planet when it abruptly fell silent. As the world watched, NASA tried frantically for days to re-establish radio contact with its precious orbiter but failed. An independent NASA review board concluded that the breakdown resulted from a rupture of a propulsion-system line as the probe began pressurizing its fuel tanks. Whatever the cause, the loss of the *Observer* meant the loss, too, of our chance to learn the truth behind Cydonia and its mysterious face.

But perhaps only temporarily: NASA has already dusted itself off after the *Observer*'s ignominious failure and begun work on substitute probes, the first of which may be launched as early as 1996. With public and congressional enthusiasm for the space program waning while interest in the Mars face mounts, will NASA make special provisions for the new spacecraft to examine Cydonia? Perhaps. Should it? In Hoagland's opinion, most definitely. While NASA was designing the *Mars Observer*, he urged it to photograph the face and other so-called anomalous structures in detail, and he continues to call for the agency to do everything within its power to resolve this otherworldly mystery.

For all his unorthodox claims, Hoagland, author of *The Monuments of Mars*, has had considerable experience working with the space community. He was a consultant to CBS News, where he designed space simulations and advised Walter Cronkite on the network's coverage of the Apollo lunar missions. In 1972, eminent planetary scientist Carl Sagan credited Hoagland, as well as British space pioneer Eric Burgess, for the initial suggestion to include a recorded message aboard *Pioneer 10*. And at the time of the Viking mission, Hoagland was under contract as an author/consultant to NASA's Goddard Space Flight Center.

Hoagland's involvement with the Cydonia controversy began in 1981 when, after seeing the work of Vincent DiPietro and Gregory Molennar at a science conference, he first wondered if the face amounted to more than a natural landform or a trick of lighting. "These two computer-imaging experts had obtained data tapes of the face and

THE FACE-SHAPED MESA ON MARS AND SOME NEARBY LANDFORMS ARE ARTIFICIAL STRUCTURES

CREATED BY INTELLIGENT BEINGS, ACCORDING TO DATA COLLECTED BY AUTHOR RICHARD HOAGLAND AND HIS TEAM OF RESEARCHERS.